

Year 10 Hybrid Term 2

Equations and Graphs

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw quadratic graphs
- Interpret quadratic graphs
- Interpret other graphs including reciprocals
- Represent inequalities

Keywords

Quadratic: a curved graph with the highest power being 2. Square power.

Inequality: makes a non equal comparison between two numbers

Reciprocal: a reciprocal is 1 divided by the number

Cubic: a curved graph with the highest power being 3. Cubic power.

Origin: the coordinate (0, 0)

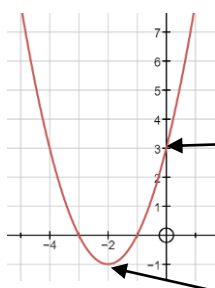
Parabola: a 'u' shaped curve that has mirror symmetry

Quadratic Graphs

$$y = x^2 + 4x + 3$$

If x^2 is the highest power in your equation then you have a quadratic graph

It will have a parabola shape



Substitute the x values into the equation of your line to find the y coordinates

x	-4	-3	-2	-1	0	1
y	3	0	-1	0	3	8

Coordinate pairs for plotting (-3, 0)

Plot all of the coordinate pairs and join the points with a curve (freehand)

Quadratic graphs are always symmetrical with the turning point in the middle

Interpret other graphs

Cubic Graphs

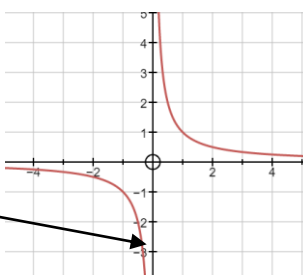
$$y = x^3 + 2x^2 - 2x + 1$$



If x^3 is the highest power in your equation then you have a cubic graph

Reciprocal Graphs

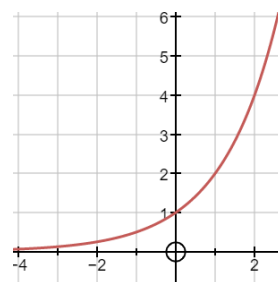
$$y = \frac{1}{x}$$



Reciprocal graphs never touch the y axis
This is because x cannot be 0
This is an asymptote

Exponential Graphs

$$y = 2^x$$



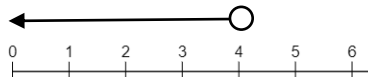
Exponential graphs have a power of x

Represent Inequalities

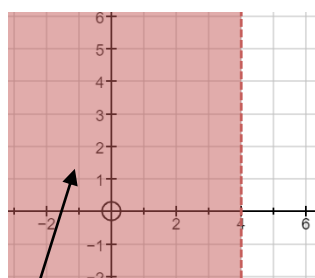
Multiple methods of representing inequalities

$$x < 4$$

All values are less than 4



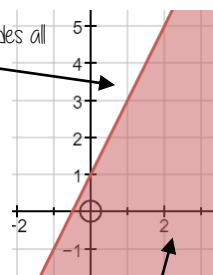
The shaded area indicates all possible values of x



The dotted line shows that the inequality does not include these points

The solid line shows that the inequality includes all the points on this line

$$y \geq 2x + 1$$



The shaded area indicates all possible solutions to this inequality

Year 10 Hybrid Term 2

Further Statistics

What do I need to be able to do?

By the end of this unit you should be able to:

- Construct and interpret frequency tables and polygon two-way tables, line, bar, & pie charts
- Find and interpret averages from a list and a table
- Construct and interpret time series graphs, stem and leaf diagrams and scatter graphs

Keywords

Population: the whole group that is being studied

Sample: a selection taken from the population that will let you find out information about the larger group

Representative: a sample group that accurately represents the population

Random sample: a group completely chosen by chance. No predictability to who it will include

Bias: a built-in error that makes all values wrong by a certain amount

Primary data: data collected from an original source for a purpose.

Secondary data: data taken from an external location Not collected directly

Outlier: a value that stands apart from the data set

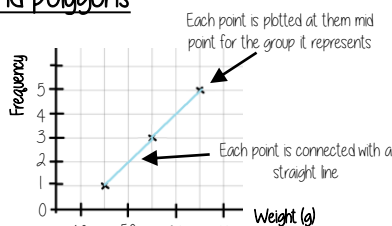
Frequency tables and polygons

x Weight(g)	Frequency
$40 < x \leq 50$	1
$50 < x \leq 60$	3
$60 < x \leq 70$	5

We do not know from grouped data where each value is placed so have to use an estimate for calculations

MID POINTS

Mid-points are used as estimated values for grouped data. The middle of each group

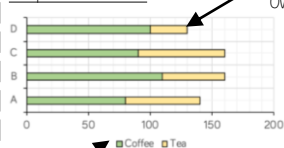


The data about weight starts at 40 So the axis can start at 40

Mid-point
Start point + End point
2

Bar and line charts

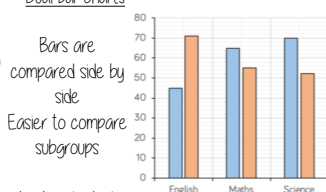
Composite bar charts



Categories clearly indicated

Compare the bars green compared to yellow. The size of each bar is the frequency. Overall total easily comparable

Dual bar charts



Bars are compared side by side
Easier to compare subgroups

Categories clearly indicated

Two way tables

60 people visited the zoo one Saturday morning
26 of them were adults 13 of the adults' favourite animal was an elephant 24 of the children's favourite animal was an elephant

Extract information to input to the two-way table

Subgroups each have their own heading

	Adult	Child	Total
Elephant	13	24	37
Other	13	10	23
Total	26	34	60

Needs subgroup totals

Overall total

Draw and interpret Pie Charts

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$

"32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

$\frac{32}{60} \times 360 = 192^\circ$



Use a protractor to draw
This is 192°

Multiple method

As 60 goes into 360 - 6 times
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)

Comparing Pie Charts

You NEED the overall frequency to make any comparisons

Averages from lists

The Mean

A measure of average to find the central tendency... a typical value that represents the data

24, 8, 4, 11, 8

Find the sum of the data (add the values)

55

Divide the overall total by how many pieces of data you have

$55 \div 5$

Mean = 11

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8

Mode = 8

This can still be easier if the data is ordered first

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8

Put the data in order

4, 8, 8, 11, 24

Find the value in the middle

4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

For Grouped Data

The modal group - which group has the highest frequency

Averages from a table

Non-grouped data

Number of Siblings	0	1	2
Frequency	6	8	6
Subtotal	0	8	12

Overall Frequency: 20

Total number of siblings: 20

The data in a list: 0,0,0,0,0,1,1,1,1,1,1,1,2,2,2,2,2,2

Mean: $\frac{\text{total number of siblings}}{\text{Total frequency}} = 1$

Grouped data

x Weight(g)	Frequency	Mid Point	MP x Freq
$40 < x \leq 50$	1	45	45
$50 < x \leq 60$	3	65	195
$60 < x \leq 70$	5	65	325

Overall Frequency: 9

Overall Total: 565

Mean: 62.8g

The data in a list: 45, 55, 55, 55, 65, 65, 65, 65, 65

Year 10 Hybrid Term 2

Further Statistics

What do I need to be able to do?

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Stem and leaf

A way to represent data and use to find averages

This stem and leaf diagram shows the age of people in a line at the supermarket.

```

0 | 7 9
1 | 4 5 6 8 8
2 | 1 3
3 | 0
    
```

Key: 1 | 4 Means 14 years old

Stem and leaf diagrams:

Must include a key to explain what it represents
The information in the diagram should be ordered

Back to back stem and leaf diagrams

Girls	Boys
5	14
7, 5, 5, 5, 4	15 3, 8, 9
8, 4, 2, 1, 0	16 2, 5, 7, 7, 8, 8, 9
9, 8, 7, 6, 6, 4, 2, 1, 1, 0, 0	17 0, 2, 3, 6, 6, 7, 7
	18 0, 1, 4, 5

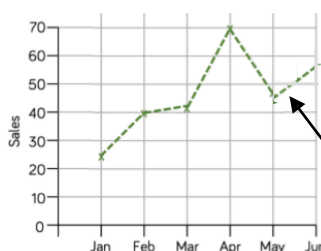
15 | 3,
Means 153 cm tall

Back to back stem and leaf diagrams

Allow comparisons of similar groups
Allow representations of two sets of data

Time-Series

This time-series graph shows the total number of car sales in £1000 over time



Look for general trends in the data. Some data shows a clear increase or a clear decrease over time.

Readings in-between points are estimates (on the dotted lines). You can use them to make assumptions.

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency

Mean, mode, median — allows for a comparison about more or less average

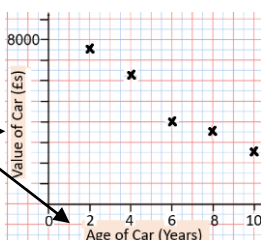
Range — allows for a comparison about reliability and consistency of data

Draw and interpret a scatter graph

Age of Car (Years)	2	4	6	8	10
Value of Car (£s)	7500	6250	4000	3500	2500

- This data may not be given in size order
- The data forms information pairs for the scatter graph
- Not all data has a relationship

All axes should be labelled

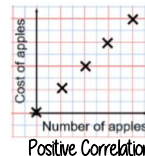


The axis should fit all the values on and be equally spread out

"This scatter graph shows as the age of a car increases the value decreases"

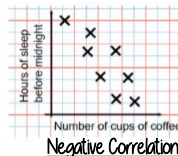
The link between the data can be explained verbally

Linear Correlation



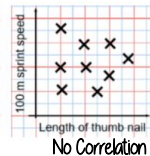
Positive Correlation

As one variable increases so does the other variable



Negative Correlation

As one variable increases the other variable decreases



No Correlation

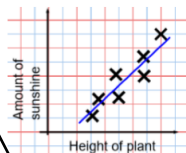
There is no relationship between the two variables

The line of best fit

The Line of best fit is used to make estimates about the information in your scatter graph

Things to know:

- The line of best fit **DOES NOT** need to go through the origin (The point the axes cross)
- There should be approximately the same number of points above and below the line (It may not go through any points)
- The line extends across the whole graph



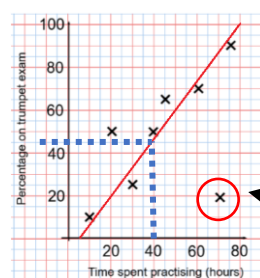
It is only an estimate because the line is designed to be an average representation of the data

It is always a straight line.

Using a line of best fit

Interpolation is using the line of best fit to estimate values inside our data point

e.g. 40 hours revising predicts a percentage of 45



Extrapolation is where we use our line of best fit to predict information outside of our data

****This is not always useful — in this example you cannot score more than 100%. So revising for longer can not be estimated****

This point is an "outlier" It is an outlier because it doesn't fit this model and stands apart from the data

Year 10 Hybrid Term 2

Congruence and Similarity

What do I need to be able to do?

By the end of this unit you should be able to:

- Enlarge by a positive scale factor
- Enlarge by a fractional scale factor
- Identify similar shapes
- Work out missing sides and angles in similar shapes
- Use parallel lines to find missing angles
- Understand similarity and congruence

Keywords

Enlarge: to make a shape bigger (or smaller) by a given multiplier (scale factor)

Scale Factor: the multiplier of enlargement

Centre of enlargement: the point the shape is enlarged from

Similar: when one shape can become another with a reflection, rotation, enlargement or translation

Congruent: the same size and shape

Corresponding: items that appear in the same place in two similar situations

Parallel: straight lines that never meet (equal gradients)

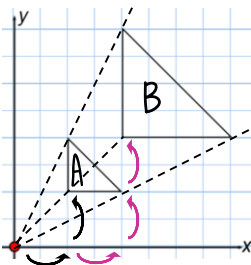
Positive scale factors

Enlargement from a point

Enlarge shape A by SF 2 from (0,0)

The shape is enlarged by 2

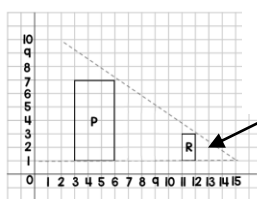
The distance from the point enlarges by 2



Fractional scale factors

Fractions less than 1 make a shape **SMALLER**

R is an enlargement of P by a scale factor $\frac{1}{3}$ from centre of enlargement (15,1)



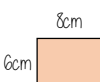
SF: $\frac{1}{3}$ - R is three times smaller than P

Identify similar shapes

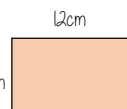


Angles in similar shapes do not change.
e.g. if a triangle gets bigger the angles can not go above 180°

Similar shapes



Compare sides: $6:8$
 $2:3$

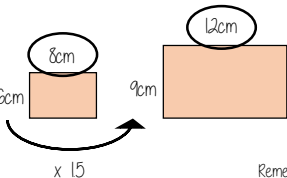


Scale Factor: Both sides on the bigger shape are 1.5 times bigger

$9:12$
 $2:3$

Both sets of sides are in the same ratio

Information in similar shapes



Compare the equivalent side on both shapes

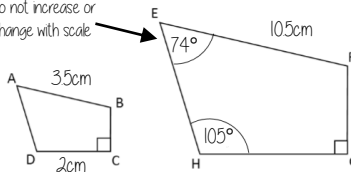
Scale Factor is the multiplicative relationship between the two lengths

Shape ABCD and EFGH are similar

Notation helps us find the corresponding sides

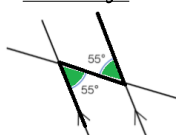
AB and EF are corresponding

Remember angles do not increase or change with scale



Angles in parallel lines

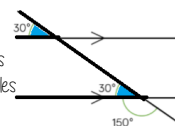
Alternate angles



Because alternate angles are equal the highlighted angles are the same size

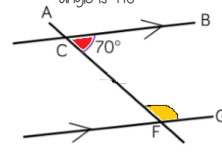
Corresponding angles

Because corresponding angles are equal the highlighted angles are the same size



Co-interior angles

Because co-interior angles have a sum of 180° the highlighted angle is 110°



As angles on a line add up to 180° co-interior angles can also be calculated from applying alternate/ corresponding rules first

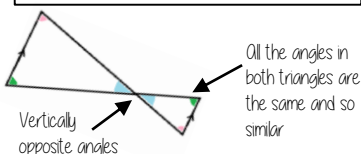
Similar triangles

Shares a vertex

Because corresponding angles are equal the highlighted angles are the same size

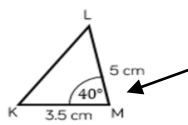
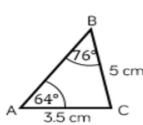
Parallel lines - all angles will be the same in both triangle

As all angles are the same this is similar - it only one pair of sides are needed to show equality



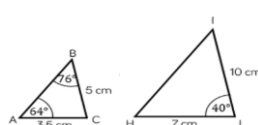
Congruence and Similarity

Congruent shapes are identical - all corresponding sides and angles are the same size



$\triangle ABC \cong \triangle KLM$

Because all the angles are the same and $AC=KM$ $BC=LM$ triangles ABC and KLM are **congruent**



Because all angles are the same, but all sides are enlarged by 2 ABC and HJL are **similar**

Conditions for congruent triangles

Triangles are congruent if they satisfy any of the following conditions

Side-side-side

All three sides on the triangle are the same size

Angle-side-angle

Two angles and the side connecting them are equal in two triangles

Side-angle-side

Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

Right angle-hypotenuse-side

The triangles both have a right angle, the hypotenuse and one side are the same